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PIPE Discounts, Premia, and Performance

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PIPE Discounts, Premia, and Performance

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Abstract

This paper explores private investments in public equity (PIPE) deals as a means of alternative firm financing. Poorly performing companies often look towards PIPEs to quickly raise capital when traditional means of financing are limited. This study provides an analysis on both the discount and premia that PIPEs are issued at, as well as the performance of firms after the deal announcement. Overall, this study finds that successful PIPEs from the investor's perspective are issued at a discount of close to 17%, and unsuccessful PIPEs are issued at an average of a 15% premium. I find substantial cumulative abnormal returns of 9% over a three-day period due to positive information shocks. Overall, this thesis corroborates past research in the field.

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I. Introduction

On April 26, 2019, both the S&P 500 and NASDAQ composite indexes achieved record highs, closing at 2,939.88 and 8,146.40, respectively (CNBC, 2019). Despite modest news of an oncoming recession, 2019 marks yet another strong period of performance. In fact, equity markets have experienced positive returns every year–except 2018–since the 2008 Great Financial Crisis.[1] Debt capital markets have also performed exceptionally well. Corporate bond issuances surpassed $1 trillion for the fifth year in a row, and is projected to continue growing (Barclays, 2019). "It's easier to raise money [now] than any time… over the past 30 years," said Carlyle Group founder David Rubenstein in 2018.

There is plenty of evidence showing that stocks have performed well–but what about the companies that haven't? Not every firm will be successful. Plenty of high quality companies end up strapped for cash due to poor investments, mismanagement, and a host of other reasons. Firms in this situation are faced with a tough choice. If management chooses not to cease operations, a likely pragmatic move is to raise more capital. But how exactly should a firm go about this?

Debt financing may be difficult because firms, especially those with negative net income, may not have the means to pay back the interest. Equity investments may also be difficult. Firms can suffer from a lack of analyst coverage, poor trading volume, or insufficient funds to cover the costs of a second public offering (Hogboom, 2004).

[1] The S&P 500 is used as a proxy for the equity markets. Returns retrieved from S&P Global website.

A. What is a PIPE?

This paper takes a deeper look into private investments in public equity, or PIPEs, as an alternative method of raising capital. PIPEs are a special type of deal that involve an investor–such as a corporation, asset manager, or high net-worth individual–purchasing equity in a public company.[2] PIPEs provide a quick means of capital for firms in desperate need. For perspective, PricewaterHouseCoopers (2017) finds that a typical initial public offering (IPO) can take as long as 12 months of work; a PIPE can take as little as a few days. The catch is that PIPEs are issued with an assortment of deal sweeteners and stipulations.

Most notably, PIPEs are often issued at a discount to the market value of equity. Target firms typically need immediate capital to survive, so they have no choice but to accept a lower valuation. Lim, Schwert, and Weisbach (2017) find that over 90% of firms issuing PIPEs are worth under $1 billion in market capitalization and have a median book asset value of only $51 million. Further, I find that the majority of firms that issue PIPEs have negative net income and junk rated credit.

Additionally, PIPEs are typically issued with restricted shares, which are then registered at a later date.[3] The discount factors in the illiquidity that investors face due to the lack of resale rights until the issuing firm registers the shares (Hogboom, 2004).

[2] A public company is defined by the Securities and Exchange Commission (SEC) as a firm that trades its securities in a public marketplace, and reports specific financial and business information to the public on a regular basis.

[3] Restricted equity is defined by the SEC as a security that is acquired in a private sale that may not be resold on an exchange, pursuant to Rule 144 of the Securities Act of 1933. When a firm issues restricted equity, it promises to file for registration to give the investor the option to sell their stake.

Stock warrants are also often added as a sweetener for the investor. A warrant is similar to a stock option in that it allows an investor to purchase shares in a company in the future at a specified price. Warrants have often been criticized for being predatory. They generally contain extreme repricing rights and antidilutive conditions if the strike price is not achieved (Hogboom, 2004). Hogboom also finds that warrants are often used as retribution if the issuing firm does not register the equity on time. Lim, Schwert, and Weisbach (2017) find that its inclusion dramatically increases the size of the discount.

Not all PIPEs come at a discount. In 2016, Google's private equity arm Google Capital (GC) purchased a $46.35 million stake in Care.com, an online provider of family care and home services. GC paid a 24% premium to the market value of equity (TechCrunch, 2016). TechCrunch notes that the firm suffered from typical ailments discussed earlier: poor financial performance and poor float. This made a PIPE issuance an attractive option. In the days after the deal announcement, TechCrunch notes that its market capitalization nearly doubled.

This begs the question of how best to calculate the placement discount. A naïve estimation of discount is simply a ratio of the PIPE equity value to the market equity value. But markets exhibit semi-strong form efficiency, where stock prices reflect new information (Fama, 1965). Therefore, a better measure of discount incorporates sufficient time for the market to price in new information. Hertzel and Smith (1993) call this the "with information" discount, and is measured as the relationship between the PIPE equity value and the market value of equity ten days after the deal announcement. Therefore, a PIPE is classified as placed at a discount if the "with information" market price exceeds the placement price. Likewise, a PIPE is classified as a premium if the placement price exceeds the “with information” market price. This definition is structurally different than the naïve interpretation. PIPE investors mandate a discount–in the naïve sense–almost always. But the true performance of the deal is a function of the pricing in of new information.

The amalgamation of deal sweeteners and the placement discount contribute to substantial alpha for investors. Lim, Schwert, and Weisbach (2017) report that investors earn an average of 4% abnormal return using a PIPE announcement play over a four day window. Hertzel and Smith (1993) find similar abnormal returns of 4.4% over the same period.

B. Hypotheses

This paper studies the sources PIPE discounts, as well as firm performance around the deal announcement. Hertzel and Smith (1993) originally hypothesized in their seminal paper that discounts are a function of asymmetric information about firm value. The global economy has changed dramatically since the paper’s publication, so this study serves to update their study with present-day information.

The main hypotheses are:

1. Hertzel and Smith Information Hypothesis: Firms where the capacity for asymmetric information is high will continue to have steeper discounts.
    a. More specifically, these will generally be smaller companies in capital-intensive industries enduring financial distress.

   b. Firms where the PIPE is placed at a discount are fundamentally different than firms where PIPEs are placed at a premium.
2. Positive shock hypothesis: Firms will exhibit positive abnormal returns in the short term due to positive sentiment from the PIPE announcement. Longer term abnormal return will likely be negative due to the introduction of new information.

As an aside, the Care.com deal referenced earlier in this section forms the motivation for this study. I participated in Claremont McKenna College's Silicon Valley Program during my junior year of college, where I interned with Care.com. This is where I first learned of private placements as a method of financing. Since then, I have been interested in sources of private placement discounts and premia, and used this study as an opportunity to explore this interest.

The rest of the paper proceeds as follows. In Section II, I provide a review of the relevant literature on PIPEs and the implications of their use. In Section III, I describe my data sources and methodologies. As I discuss the data, I also provide some insightful market trends. In Section IV, I discuss my results. This section is broken into two parts. The first is a discussion of PIPE discounts in relation to firm attributes, followed by a multivariate regression analysis. The second part presents an event study around the deal announcement period. Lastly, Section V concludes the paper by summarizing the arguments, identifying limitations of the study, and offering future points of research.

II. Literature Review

There is meaningful research on PIPEs as an alternative method of capital raising, but much of it is dated and may no longer accurately represent the current economic situation. Among the most notable research is done by Hertzel and Smith (1993), which explores reasons for both the equity discount and post-PIPE performance. Hertzel and Smith hypothesize that discounts on private placements arise from asymmetric information, in both the value of public information, and in anticipated changes in managerial performance. The authors find that private placement discounts are associated with the costs of uncovering the asymmetric information, and that deeper discounts are linked with higher discovery costs. Deep discounts also are typical for smaller placements, with the discount decreasing as the placement amount increases. In terms of performance, the Hertzel and Smith find that there is significant positive market reaction which drives up firm share price but is not sustainable in the long term.

A similar study was conducted to examine private placement discounts in China (Lu, Si-fei, & Wei-xing, 2011). The authors find that Chinese PIPEs act in similar fashion to American PIPEs. Investors still get the benefit of deep equity discounts, and positive market reactions still occur on average. However, the study finds that equity discounts may be even deeper for Chinese firms than American firms, and the {-3,0} day period has higher returns on average. These findings are in line with Hertzel and Smith's findings.

A more recent study shows that firms seeking private placements will overstate their earnings in the reporting quarter preceding the PIPE (Chen et al., 2008).

Specifically, current accruals will be overstated in an effort to portray increased revenue. A sophisticated investor, therefore, will require a deeper discount on equity to account for the inflated earnings. The authors estimate that the mean discount is 10%. Further, the magnitude of overstatement is directly related to the long-term performance of the firm, where more aggressive earnings inflation leads to worse long-term performance. In the short term, however, market reactions to private placements are generally very positive, with the discount-adjusted cumulative abnormal return averaging almost 16% in the {-3, 0} period.

Work has also been published on the types of investors that place engage in PIPEs, including deal structure and post equity-issuance performance. Brophy, Ouimet & Sialm (2004) finds that firms that receive private placements from hedge funds typically perform worse that firms that find other types of investors. In terms of deal structure, the study analyzes both traditional and structured PIPEs. Firms that issue structured PIPEs perform worse than firms that issue traditional PIPEs. This happens because of the generous repricing rights granted to investors in structured deals that activate when the stock price falls. In contrast with the Chen et al. study, this paper does not find abnormal returns for traditional PIPES from non-hedge fund investors.

In terms of the PIPE underwriting, Erhemjamts and Raman (2012) find that investment bank reputation plays an important role in the equity discount. They find that over 90% of firms use placement agents like banks, and moreover, that agent reputation is correlated to more profitable and liquid investments. Since agents act as information intermediaries, the presence of a more reputable bank on the deal may indicate large asymmetries. Interestingly, when firms partner with reputable agents, their equity is sold at a lower discount relative to firms with less reputable agents. However, the authors find that more frequent contact with agents is correlated to higher fees. Further, banks are able to have a more sustained flow of material non-public information, meaning that a long relationship indicates both information asymmetry and a good investment opportunity.

On a broader level, Chem, Dai, and Schatzberg (2008) conducted research on financing options for firms, specifically between PIPEs and secondary equity offerings (SEOs). Both methods of post-IPO financing are important for firms, but PIPEs may have better properties for firms. These properties stem into three categories. First, firms may not have enough access to capital to engage in an SEO, meaning that the PIPE market is much larger and more accessible. Second, as Hertzel and Smith found, there is a high degree of information asymmetry due to the undervaluation of firms requiring injections. Therefore, firms will typically choose to have a private placement in hopes that the relative discount on equity will be smaller than if raising capital through the public markets. Lastly, issuance costs are lower for PIPEs than for SEOs, so any rational, cost-minimizing firm will choose a PIPE instead.

Lim, Schwert, and Weisbach (2017) conducted a comprehensive study on the deal terms of PIPEs, specifically in the context of determining the cost of issuance. In addition to studying the discount and returns of deals, the authors cover the implications of the equity issuance themselves. First, they note that an overwhelming majority the transactions sell unregistered shares. Thus, investors cannot sell their equity until the shares are registered with the SEC, which often takes up to 100 days. In terms of deal structure, the authors note that almost half of PIPE issuances involve structured products like stock warrants. Using the Black-Scholes model, they find that the inclusion of warrants nearly doubles the average placement discount from 6.3% to 11.2%. Abnormal returns for the PIPE investor increase significantly too.

Finally, Chakraborty and Gantchev (2012) propose an alternative role for private placements: that PIPEs can increase shareholder coordination and help lower chances of default. Because many features of PIPE investments require shareholder approval, such as issuing more than 20% of outstanding shares at a discount, the authors of this paper study congruency between shareholder votes in the context of raising capital. The study finds that increased coordination of incumbent shareholders leads to a decreased private placement discount. Additionally, the authors find that PIPEs increase the financial value of the firm post-issuance in the long term. This seems to be a direct contradiction to previous literature. However, the study finds that firms that engage in PIPEs have higher probabilities of favorable debt renegotiations within a year of equity issuance.

III. Data & Methodology

A. Data Sources

The data used in this study comes from three sources. The first dataset is provided by Pitchbook. The raw data is a panel comprised of all completed PIPE investments of American firms from December 1998 – November 2018.[4] The observations were trimmed to only include those where the deal announcement date, deal size, and deal

[4] The full dataset is much larger, but due to the lack of efficiency in the private markets, many observations were incomplete or incorrect. Each observation includes a description of the deal terms, which I used to validate the data.

share price are provided. I also stipulated that at least one investor is based in America. This yielded a sample size of 149 observations. When further trimmed to exclude observations where the percent acquired is not given, the sample size shrunk to 49 observations. Because of the small sample size, the analysis in this paper will be done with the 149 observations that includes both known and unknown acquired percentages, except where otherwise noted. A complete list of variables and definitions can be seen in Table 1.

The second and third datasets are provided via Wharton Research Data Services (WRDS). The Center for Research in Security Prices (CRSP) is used to gather a panel of daily stock data. It includes stock price, shares outstanding, and benchmark daily returns, and is used to extrapolate market capitalization and cumulative abnormal return.[5] CapIQ, provided by S&P Global, is also used. It includes firm financial metrics and credit ratings by date.

B. Methodology

Python is used to query, clean, and analyze the dataset. To query the stock-level data, I use the firm list from Pitchbook to pull the associated ticker data from CRSP. However, since PitchBook and CRSP do not use the same identification system, each ticker is first matched to a PERMCO, a unique firm identifier provided by CRSP. Each ticker is queried for data in the period {-30} and {-4, 10}, where negative numbers represent days prior to day 0 and positive numbers represent days following day 0. Day 0 is defined as the announcement date of the PIPE, which is provided by PitchBook. Day

[5] The benchmark selected is the S&P500.

{-30} is used to compute the firm market capitalization without any noise from the PIPE announcement. Finally, the Python package Pandas Market Calendars is used to remove weekends, holidays, and other non-trading days from the queried data.

To query the financial information from CapIQ, I first had to map each ticker to a GVKEY, since S&P uses yet another identification scheme. Using a GVKEY and announcement day pair, I collected information from the 10-Q that precedes the PIPE announcement, so no information bias is factored into the ratios.

The two main dependent variables, the market discount and cumulative abnormal return, are given by the equations:

$$\boldsymbol{Discount_{i,t}} = \frac{(\boldsymbol{P_{i,t+10}} - \boldsymbol{P^{*}{}_{i}})}{\boldsymbol{P_{i,t+10}}} \tag{1}$$

$$\boldsymbol{CAR_{i,t}} = \sum_{t=1}^{t=T} \boldsymbol{R_{i,t}} - \boldsymbol{E}(\boldsymbol{R_{i,t}}) \tag{2}$$

The discount for deal *i* is measured by the change in stock price ten days after the deal announcement day ($P_{i,t+10}$) and the share price that the investor paid ($P^{*}{}_{i}$), divided by the stock price 10 days after the deal announcement. This is the same formula used by Hertzel and Smith. The metric reflects the magnitude of the private placement discount for the investor with information. The parity of the sign on Discount represents if the investor paid a discount (positive) or premium (negative) relative to the trading price. This methodology of calculating discount is used as opposed to the ratio of the current trading price and investor share price because it prices in the information shocks embedded within the announcement period.

The discount is studied in two ways. First, I show the relationship between discount and different firm attributes. The attributes studied comprise of financial, investment related, and firm related metrics. The second uses OLS multivariate regression to explore different factor determinants and weights of the discount.

Yet, research shows that oftentimes firms actually pay a premium for shares. This paper is novel in that it conducts regressions at the aggregate level, and then breaks it down to the discount-only and premium-only level. This provides insight into overall factors of private placement discounts, as well as specific factors that are unique to discounts and premia individually.

To measure the returns for each deal, I use a cumulative abnormal return (CAR). This is the sum of the abnormal returns from period {t, T}. The stock expected return $E(R_{i,t})$ is calculated using a Fama-French three-factor model, which takes into account factors including size, book to market value, and market capitalization. I use this model rather than a market model because more of the variation in returns is explained. I use a cumulative measure for the event study because it allows for information to become priced in at any date during the study period. The CAR is specified with the following estimation parameters. The window used to estimate the expected return is 100 days, and there is a 50-day gap between the estimation window and event study period.

C. Data Description and Summary Statistics

In-Sample Data.

Summary statistics for the sample can be seen in Table 2. The sample corroborates that a typical firm that engages in a PIPE is midsized and poorly performing. The average firm age is around 35 years old and employs over 2000 people. These seem like healthy metrics, yet, the financial metrics tell another story. The mean market capitalization is just under $200 million, but the median market capitalization is only $20.69 million. Further, the standard deviation of firm size is enormous. Cash flow margin is negative on average. And even though mean firm net income is $42 million, it has a standard deviation of $848 million. These data corroborate the notion that struggling companies are often a target demographic for private placements. It also portrays the deal-by-deal nature of PIPEs.

Regarding the actual investment, the median deal profile is fairly small, at only $25 million. Deal size varies drastically, with it ranging between $30,000 and $3.7 billion. Investors typically seek an 18% stake but can approach almost 50%. It is important to note the limited amount of observations for this variable. This is attributable to either Pitchbook not providing the metric for all of its observations, or by nature of the private markets not disclosing all the deal terms.

Investments are often syndicated among multiple investors. The average number of investors in-sample is 1.93 firms, with a maximum of eight. Interestingly, there is evidence that the buy-side firms investing in PIPE issuances have different incentives than firms that invest at earlier stages of a firm's life. Out of the 1.93 investors, 1.71 of the investors are new. Investors understand that the target is typically performing poorly and that future returns are uncertain. Yet, they still require a discount to market value even though it will degrade the firm's valuation. So rather than having a traditional growth thesis, buying parties have much more leeway on the target's performance. Evidence from Brophy, Ouimet & Sialm (2004) suggests that investors with high risk tolerance–such as hedge funds–stipulate sweeteners like convertible debt and repricing rights in the case of poor performance that lead to higher returns for the fund but can be detrimental to the firm. The study also highlights how hedge funds typically hedge their investments, increasing the likelihood of returns regardless of the firm's performance.

PIPE Market Trends.

Table 3 provides some insight into the marketplace for private placements. Overall, there are 2546 deals captured by Pitchbook between 1998 and 2018. Because the sample used in this study only includes observations with sufficient data, I inspect both in-sample and out-of-sample PIPE trends as a sanity check. Both Figure 1 and Figure 3 exhibit the same trends and properties, which ensures that the sample is a fair representation of the population. Figure 2 and Figure 4 are the percent changes of yearly deals in and out of sample. Interestingly the process in Figure 4 is fairly stationary, except structural breaks in 1994, 1999, and 2008, which coincide with the 1994 Great Bond Massacre, 1999 Dot-Com bubble burst in, and 2008 Great Financial Crisis.

In terms of firm composition, Figure 5 shows that Healthcare firms are most likely to raise money privately, in line with the paper's hypothesis. This is likely due to capital-intensive pharma companies requiring quick cash injections to recover costs associated with expensive FDA trials or failures.

Lastly, Figure 6 looks at the number of days between the PIPE announcement and the actual day it is executed. Interestingly, only 30% of firms execute the deal within a week of announcement. Almost 50% of firms take more than a month from the announcement date to execute the deal. Perhaps firms try to capitalize on positive information effects twice: once from the announcement and again from the close.

IV. Results

Discounts and Premia

Figure 7 shows the distribution of Discount. It is approximately normal but is moderately negatively skewed and has slightly thin tails. As a sanity check, is worth nothing that the distribution is centered on a positive mean, which represents a discount. However, it is still interesting to see a large number of investors paying a premium.

Table 4 helps explain this by presenting key descriptive statistics about Discount. The ‘aggregate’ column describes the entire sample, and the proceeding columns describe the subset of PIPEs where the deal is effectively a discount or premium, respectively.

In the aggregate, investors on average pay a 6.56% discount to the market value of equity. But that number does not tell the whole story. The true discount that investors receive is much closer to 20%. But the discount also varies drastically, with a standard deviation of over 21%. This is attributable to the wide range of reasons that firms seek private investment, as well as from a variety of firm-specific characteristics including profitability and lifecycle stage.

In regard to the premium, I find that firms end up effectively paying about 11-17% above market rate. There are two likely reasons that a firm would pay a premium. Fund managers may pay a premium to outbid competition in pursuit of alpha. As the number of PIPEs per year generally increases, investment firms may engage in bidding wars with each other, which in turn drives up the investment price. The second theory is that investors negatively reacted to the deal announcement and drove share price down.

Discounts and Firm Attributes.

Table 5 takes a deeper look into the drivers of PIPE discounts. Discount and premium magnitude do not exhibit much variation between industries. Private markets are likely deep and liquid enough that firms can seek investment from any accredited investor, regardless of industry experience. It is interesting to note that the absolute value of an industry's discount tends to be close to its premium. This implies that information shocks are just as strong in both the positive and negative directions.

Regarding specific industries, IT firms tend to have the tightest range. This is likely due to the oversaturation of private technology investors driving prices towards their fair values. Additionally, the opportunity cost of raising money by other means may be too costly. Many public technology companies have negative net income, which makes paying off debt payments difficult. And equity financing may not be possible due to low trading volume.

Next, using net income as a proxy for profitability, it is not a surprise that unprofitable firms have a much steeper discount than profitable ones. Market investors are expected to react positively to the capital injection. This supports the thesis that positive information effects are stronger for less profitable firms.

Credit rating is used as one of the proxies for financial distress. Firms with poor credit rating tend to receive both the highest premium and discount. The former is likely due to positive information effects. The latter hints at the predatory nature of some PIPEs, whereby some deals do not end up being good values for the firm. Overall, this more importantly shows that firms with poor credit are more likely to be PIPE targets. There are more firms in-sample with C rated credit than firms of all other credit scores combined.

Percent acquired seems to be an important factor for discount magnitude. Intuitively, it makes sense that larger fractions come at steeper discount. Investors require compensation for larger ownership positions in the form of a market discount. Most PIPEs occur between the 10-20% level. Investors are unlikely to spend time and resources for smaller positions, and firms in financial distress will need to sacrifice a meaningful amount of equity to raise an adequate amount of capital. Rule 144A states that firms must receive shareholder approval before selling more than 20% of outstanding float.

Along with percent acquired, deal size is an important determinant in discount. There are large discounts for $5-20 million deals. Interestingly, premium increases as the deal size increases. Larger deals likely signal deeper financial distress, which may scare investors.

Book / market value of equity is used to describe a degree of over- or undervaluation of a firm. Higher values are expected to signal undervaluation. The results show a modest increase in discount as the ratio increases.

The discount seems to be agnostic to firm size as measured by market capitalization. Even though the majority of firms are worth under $100 million, a firm of any size can issue a PIPE. It is expected that investors would require a naïve discount regardless of the firm size. It does not matter whether an investor places in a small biotech firm, or much larger cases, such as Berkshire Hathaway investing in Goldman Sach's bailout private placement in 2008.

Debt / equity is a good proxy for financial distress. The data shows the firms with extreme debt / equity receive steeper discounts. For example, firms with negative debt to equity have the steepest discount. This occurs when the book value of equity becomes negative due to negative retained earnings. Similarly, firms with debt / equity ratios of 10 and above have steep discounts, likely as a reaction to the upcoming boost in equity.

The sample is fairly evenly split between PIPEs with a single investor and PIPEs with multiple investors. In the aggregate, having multiple investors nearly doubles the average discount. This is likely a result of the asymmetric power that investors yield.

Multivariate Regression Results.

Table 6 presents six models for measuring the discount. All models were computed using linear regression with heteroscedasticity robust standard errors.

Model (1) tries to model discount by using mixed effects. It projects the discount as a function of log of firm size, percent acquired, and an interaction term between the two. Overall, 29.4% of the variation in the discount is explained. The constant and market capitalization are both significant at the 1% level. The coefficient on constant is 0.331, and the coefficient on log of market cap is -0.101. Therefore, as firms become larger, the discount to share price becomes smaller. At the same time, as the percent acquired increases, the discount increases linearly.

Model (2) builds off of (1) but adds a variable for log of deal size. Log of deal size and log of market cap are both significant at the 1% level. The constant loses some power, becoming significant at the 5% level, and percent acquired loses significance. This model again shows that the discount transitions to a premium as the firm size grows. But the discount is increase as deal size grows too. This model predicts that a 10% increase in log of market cap would decrease the discount by 1.49 percentage points.

Model (3) introduces credit rating and book / market equity and takes out the interaction variable. This model loses some predictive power compared to models (1) and (2). Only 22.6% of the variation in discount is described by this model. The coefficients on B+ and B rated credit are negative and not significant. However, the coefficient on a C rated credit is negative and significant at the 1% level. This model projects that it is beneficial to have poor credit rating. We have seen evidence of this before. As shown in the previous section, firms with low credit scores tend to also have the largest positive shareholder reaction.

Therefore, model (4) attempts to control for credit by adding a debt / equity term. Cash flow margin is also added as an additional measure of financial distress. Credit rating C is still significant, but now at the 5% level, along with cash flow margin. This model, while only having an adjusted R^2 of 24.1%, starts to create an intuition for how the discount is modeled. The coefficients on all non-junk rated credit are insignificant. So even if a firm has good credit, it is not powerful enough to explain a premium or discount. On the other hand, a credit rating of C brings the discount down to under 10% from 29.2%. At the same time, the coefficient on cash flow margin is negative, meaning more efficient companies bring the discount down further towards a premium. Finally, log of market is significant at the 1% level, and has a negative coefficient. Therefore, a discount is likely to turn into a premium with large, efficient firms that are going through financial troubles.

Model (5) is based on the regression in Hertzel and Smith's paper. 41.6% of the variation in discount is explained by this specification. Credit rating is removed and replaced with other metrics of financial distress. The new measures are two binary variables for profitability, "Generating Revenue; Not Profitable," and "Profitable". The former equals 1 if net income is negative and EBITDA growth is negative, and the latter equals 1 if a firm had year-over-year EBITDA growth accompanied with contemporaneous positive net income. These variables are not mutually exclusive, and a 0 for both implies that a firm has no profit but increasing EBITDA growth. A binary variable for single investor is added to measure effects on number of investing participants. Percent acquired is also added back.

There are several notable features about this model. First, the constant is negative, which implies that firms start at a premium, and certain characteristics drive the stock price towards discount. The two new profitability variables are both significant at the 5% level. Having no profit and decreasing EBITDA margin eliminates the premium entirely. This intuitively makes sense, as investors typically invest in companies with future potential growth, and this variable hints at the firm's struggles. Having positive net income and EBITDA growth also wipes out most of the premium, interestingly. This may be due to investors' willingness to pay closer to market price for these investments. Again, results find that the sweet spot for PIPEs are the firms that are unprofitable but have high future potential growth. Lastly, log of deal size and percent acquired are both significant at the 1% level.

Compared to the Hertzel-Smith model, both specifications have the same amount of predictive power.[6] Hertzel and Smith also include two additional variables that measure the impact of change in ownership structure. They include a binary variable that represents if the placement used restricted shares, which is significant at 1%, and a variable for management buyer, which is not statistically significant. The sign, power, and magnitude of the coefficients in the new specification are for the most part consistent with the original model. The main difference is the number of observations. Because the Herzel-Smith paper uses a more comprehensive dataset, they were able to achieve more observations.

Lastly, model (6) combines elements of each regression. The model explains 72% of the variation in discount, but only has 23 observations. The results from this regression corroborate the findings from the previous specifications. “Generating Revenue; Not Profitable” and “Profitable” are both significant at 1%. Credit rating B+ becomes significant at 1% but is likely due to the small sample size. Credit rating C remains significant at 1%. Log of deal size is negative, as expected, due to economies of information. Neither percent acquired nor single investor are significant, indicating that they are weak predictors of the discount.

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[6] The R^2 of the Hertzel-Smith model is 41.3%. This is a difference of 0.02 compared to the specification in this paper.

D. Performance

Lastly, Table 7 shows the abnormal return for several different investment periods. Abnormal return is measured using both a CAR. Buy-Hold Abnormal Return (BHAR) and the Patell Z of the CAR are included as a robustness check. As with a normal Z test, the CAR Patell Z (hereon, Z) tests for a difference in distributional mean. In this case, it is testing if the CAR is significantly different than the market return. This test is unique in that it standardizes the event period using the standardized CAR, so each period can be compared.

CAR is positive and highly significant in all of the event periods. For shorter periods, including {-3, 10}, {-3, 0}, {0, 3}, and {0, 10}, it does not matter if a market investor had prior information. Simply trading on the new information and holding until day 10 generates exceptional abnormal returns of 9.93%. In fact, even if an investor has prior information about the PIPE announcement and trades on it over the {-3, 0} period, he or she would generate the least amount of abnormal return.

However, BHAR tends to have better properties in longer-run event studies (Gur-Gershgoren, Hughson, Zender, 2008). Even though the CAR is positive and significant in the {0, 150}, {0, 300}, and {0, 500} day periods, the mean BHAR decreases exponentially as time increases. Further, the Z becomes relatively less significant. Therefore, long-run buy-and-hold strategies do not perform well. This is likely due to substantial new information about firms that gets incorporated into the returns. Perhaps the PIPE is unsuccessful, or perhaps the firm mismanages the new capital and undergoes Chapter 11.

Overall, investors react exceedingly well when firms announce their intention to raise capital. However, abnormal returns are poor in the long run because material new information drastically affects the firms.

V. Conclusion

This study explores PIPEs as a method of financing for firms, specifically in regard to the placement discount. Overall, the study agrees with previous literature. PIPE investors still enjoy sizeable discounts and large abnormal returns.

The results agree with the Hertzel and Smith Information Hypothesis. Firms that are more difficult to value tend to have deeper placement discounts. This difficulty of valuation manifests in poor firm performance, such as poor credit rating, high book to market ratios, and negative net income.

The key difference between firms that place equity at a discount versus a premium lie in the future earning potential of the company. The firms themselves are not exactly different, contrary to the hypothesis, but their growth prospects are. Deal size is an important explanatory variable here. Larger deals likely convey a higher degree of financial distress. Additionally, having too much debt relative to equity is a dangerous factor that is likely hard to overcome in the future. On the other hand, firms placed at a discount had positive EBITDA margins, as shown by the regression models, and other signs of future profitability.

One important limitation in the study is the small amount of observations. The data from Pitchbook is useful, but not as comprehensive as other sources. PrivateRaise, which is used in a number of other studies, seems to be the best source for future research on PIPEs.

This study has opened various areas for future study. Earlier in this paper I brought up the question of why firms wait to execute the PIPE after its announcement. An event study would be an interesting topic to pursue to understand if firms benefit twice from positive information effects.

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VII. Tables and Figures

Table 1 - Variable Descriptions

Variable Class	Variable Name or Category*	Variable Description
Independent Variables	Discount	(Stock price 10 days after PIPE announcement – PIPE share price) / Stock price 10 days after PIPE announcement.
	Cumulative Abnormal Return	Cumulative abnormal return on a stock using a Fama-French three-factor model. The CAR period is specified as $\{t_0, t_1\}$.
Dependent Variables	Percent acquired	Percentage stake acquired.
	PIPE share price	The share price that the investor purchased shares at.
	Deal Class	A categorical variable describing the purpose that a firm engaged in a PIPE. Reasons include: Corporate, Hedge Fund, Venture Capital, Private Equity, and Other.
	Single Investor	Binary variable if the PIPE only had a single investor.
	Market Capitalization	Share price * number of shares outstanding 30 days prior to PIPE announcement.
	Deal Size	Total dollar amount in ‘000s that a firm raised with the PIPE.
	Raised to Date	Total dollar amount in ‘000s that a firm has raised, inclusive of the PIPE.
	Employees	Number of employees contemporaneous to PIPE.
	Number of Investors	Total number of PIPE investors.
	Number of New Investors	Number of PIPE investors who have not previously invested in the firm before.
	Profitability Measures*	Revenue, Gross Profit, Net Income, EBITDA, Total Debt, EBITDA Margin, Market Capitalization. All are from the quarter prior to the PIPE.
	Firm Age	Calculated as 2019 – founding year
	Financial Distress Measures*	Cash Flow Margin, Cash Flow / Total Debt, Cash Ratio, Interest Coverage Ratio, Long Term Debt / BV Equity, Quick Ratio, Return on Equity, D/E, Credit Rating. All are from the quarter prior to the PIPE.
	Book / Market Equity	Book value to market value of equity in quarter prior to PIPE.

*** Denotes a category header.**

Table 2 - Independent Variable Summary Statistics

Variables	Mean	Median	S.D.	Min	Max	Obs
Deal Size	153.29	25	420.78	0.03	3700.00	149
Percent Acquired	17.64	15.2	10.30	5.00	49.80	46
Raised to Date	318.89	131.01	638.34	0.03	3973.01	148
# Employees	2353.85	223.50	6675.35	4.00	56000.00	126
# Investors	1.93	1	1.58	1.00	8.00	149
# New Investors	1.71	1	1.21	1.00	7.00	121
Revenue	849.87	50.57	3260.00	0.00	32363.00	129
Gross Profit	196.49	28.09	403.46	-133.23	2172.67	84
Net Income	42.27	-13.36	848.35	-1921.95	8600.00	130
EBITDA	23.70	-8.18	253.56	-1479.79	1005.37	113
Total Debt	6090.46	53.68	47656.92	0.00	483732.00	103
EBITDA Margin	-1355.41	-15.54	4681.75	-33060.14	108.37	99
Firm Age	34.67	23	32.93	4.00	166.00	144
Market Capitalization	196.12	20.69	755.89	1.45	6457.22	105
Book / Market Equity	0.71	0.401	0.80	0.01	5.21	83
Cash Flow Margin	-12.54	-0.09	53.01	-374.61	1.43	76
Cash Flow / Total Debt	-1.08	-0.06	2.63	-13.10	0.86	85
Cash Ratio	10.03	1.05	54.33	0.01	450.94	69
Interest Coverage Ratio	-259.66	-1.25	875.11	-4780.30	220.54	47
Quick Ratio	10.58	2.19	54.32	0.08	451.47	69
Return on Equity	-0.80	-0.43	1.76	-13.86	0.72	84
Total Debt / Equity	3.04	0.98	5.59	-9.74	24.34	88
Single Investor	61.00	1	49.00	0.00	100.00	149

All financial metrics are in millions, except for ratios, percentages, and per-share items.

Table 3 - PIPE Industry Trends

Figure 1 - PIPEs by Year: In-Sample

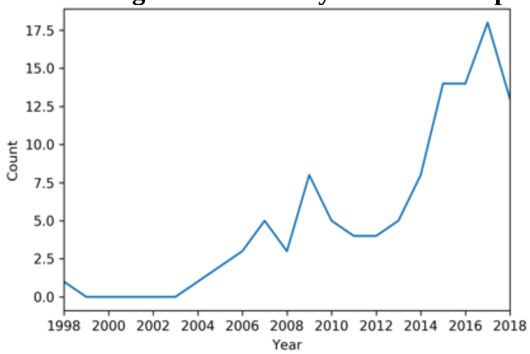

Figure 2 - Change in PIPEs by Year: In-Sample

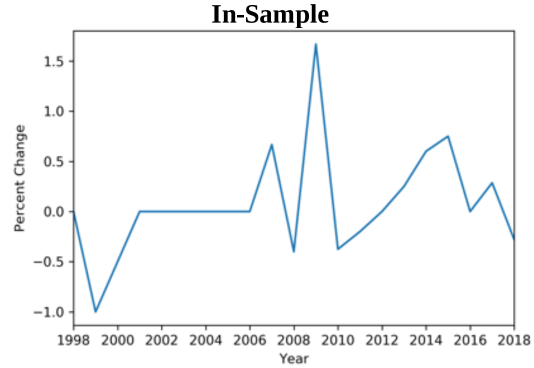

Figure 3 – PIPEs by Year: Out-of-Sample

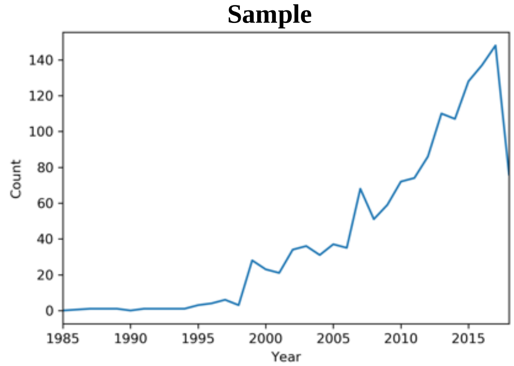

Figure 4 – Change in PIPEs by Year: Out-of-Sample

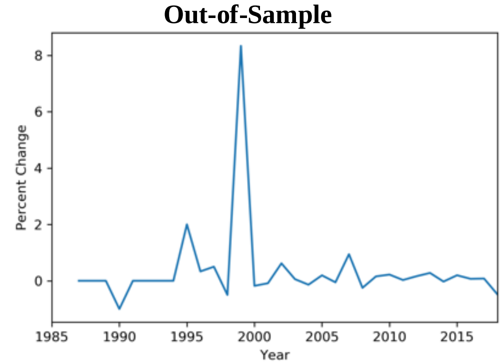

Figure 5 – PIPEs by Sector

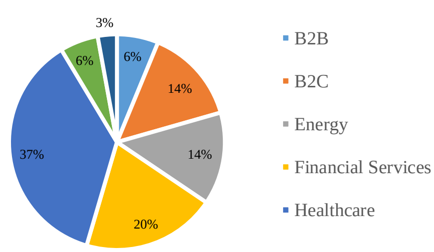

Figure 6 – Time Between Deal Announcement Date and Execution

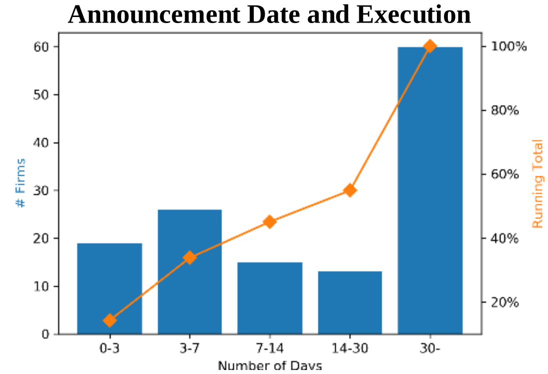

Figure 7 – Distribution of Discounts and Premia

This table presents a histogram of the independent variable Discount. Positive number represent discounts and negative numbers represent premia. The data is winsorized to three standard deviations to remove outliers.

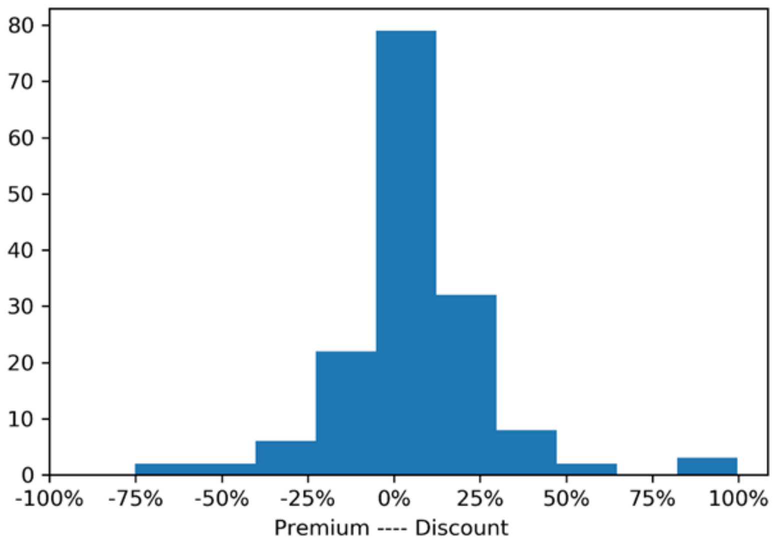

Table 4 - Summary Statistics of Discounts and Premia

This table looks at PIPE discounts from three lenses: in the aggregate, discount-only, and premium only. Due to how Discount is calculated, all positive numbers represent discounts, and all negative numbers represent premia.

	Aggregate	Discount	Premium
Count	156	106	50
Mean	6.68%	17.08%	-15.35%
S.D.	23.28%	17.94%	17.23%
Min	-75.22%	0.00%	-75.22%
25%	-0.88%	7.09%	-18.37%
50%	7.09%	10.18%	-10.56%
75%	17.98%	24.14%	-1.73%
Max	99.77%	99.77%	-0.42%

Table 5 - Discount Magnitude on Firm Characteristics

This table presents PIPE discounts and premia grouped by different firm characteristics. Each grouping is performed on the available data, so the sum of the grouping's aggregate count does not necessarily equal the total number of observations.

		Aggregate		**Discount**		**Premium**	
Characteristic	Grouping	Mean	Count	Mean	Count	Mean	Count
Firm Industry	Business Products and Services	20.45%	9	20.45%	9		
	Consumer Products and Services	0.98%	12	21.48%	6	-19.52%	6
	Energy	11.10%	13	30.44%	9	-32.41%	4
	Financial Services	7.79%	25	17.56%	18	-17.34%	7
	Healthcare	3.62%	34	21.09%	18	-16.03%	16
	IT	0.13%	6	7.85%	3	-7.60%	3
	Materials and Resources	3.32%	3	17.02%	1	-3.53%	2
Net Income	Negative	7.77%	74	23.77%	46	-18.51%	28
	Positive	3.34%	28	12.77%	18	-13.63%	10
Credit Rating	A-	13.53%	5	13.53%	5		
	B+	3.51%	9	5.83%	7	-4.62%	2
	B	22.89%	7	22.89%	7		
	B-	4.86%	10	11.63%	7	-10.95%	3
	C	2.76%	32	19.37%	18	-18.58%	14
Percent	0-10	-8.82%	7	11.66%	2	-17.01%	5
Acquired	10-20	11.29%	20	24.59%	14	-19.75%	6
	20-	21.28%	6	21.28%	6		
Deal	0-5	5.67%	10	15.94%	6	-9.72%	4
Size	5-10	36.85%	8	36.85%	8		
	10-15	11.24%	9	21.02%	6	-8.32%	3
	15-20	28.27%	11	31.84%	10	-7.46%	1
	20-100	-0.59%	31	14.16%	18	-14.42%	13
	100-	-2.32%	33	14.51%	22	-25.17%	11
Book / Market	0-0.2	2.58%	21	19.32%	12	-19.74%	9
	0.2-0.4	3.02%	18	13.93%	10	-10.61%	8
	0.4-0.7	9.80%	11	21.42%	7	-10.53%	4
	0.7-1	3.76%	9	10.99%	8	-54.08%	1
	1-	9.00%	21	15.86%	16	-12.97%	5
Market	0-10	19.19%	38	31.44%	27	-10.87%	11
Capitalization	10-100	1.93%	41	12.13%	28	-20.04%	13
	100-1000	-7.26%	19	13.25%	8	-22.18%	11
	1000-	-0.47%	4	28.57%	1	-10.15%	3
Debt / Equity	-0	17.46%	6	31.20%	4	-10.01%	2
	0-1	4.85%	37	19.84%	22	-17.13%	15

	1-3	4.86%	19	11.55%	13	-9.64%	6
	3-10	4.39%	14	16.47%	10	-25.81%	4
	10-	11.08%	9	15.05%	7	-2.82%	2
Investor Type	Single Investor	4.80%	60	22.76%	37	-24.07%	23
	Multiple Investors	9.06%	42	17.83%	27	-6.72%	15

Table 6 - Regression Models

Credit rating is a binary variable that equals 1 if a firm's credit rating equals the respective rating.

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.331* (0.169)	0.394** (0.175)	0.332** (0.133)	0.292** (0.132)	-0.306 (0.188)	-0.115 (0.172)
Generating Revenue; Not Profitable					0.408** (0.160)	0.533* (0.079)
Profitable					0.295** (0.128)	0.475* (0.043)
Credit Rating B+			-0.096 (0.067)	-0.085 (0.065)		0.455* (0.058)
Credit Rating B			-0.083 (0.066)	-0.073 (0.066)		-0.201 (0.117)
Credit Rating B-			0.037 (0.072)	0.039 (0.069)		0.094 (0.123)
Credit Rating C			-0.174* (0.087)	-0.193** (0.092)		-0.149* (0.073)
Book / Market Equity			0.018 (0.026)	0.034 (0.030)	0.036 (0.033)	-0.031 (0.033)
Cash Flow Margin				-0.005** (0.003)		
Ln(Deal Size)		0.044* (0.024)	-0.005 (0.024)	-0.009 (0.024)	-0.039* (0.019)	-0.049* (0.007)
Ln(Market Cap)	-0.101* (0.037)	-0.149* (0.051)	-0.051** (0.021)	-0.041* (0.021)		
Percent Acquired	0.003 (0.005)	-0.001 (0.005)			0.012* (0.004)	0.009 (0.007)
Percent Acquired * Ln(Market Cap)	0.001 (0.002)	0.001 (0.002)				
Single Investor					0.030 (0.107)	-0.050 (0.093)
Debt / Equity				-0.002 (0.005)		
Obs	33	33	58	56	27	23
Pr(F-value)	0.004	0.005	0.005	0.008	0.012	0.003
Adj R-squared	0.294	0.314	0.226	0.241	0.416	0.720

Heteroskedasticity robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 7 – PIPE Performance

This table presents the cumulative abnormal return (CAR) and buy-hold abnormal return (BHAR) for different event periods. Day 0 represents the PIPE announcement date. All of the statistics are normalized to the respective event period's end date. The Patell Z is included as a robustness check for CAR.

Information Status	Event Period	Mean CAR	Mean BHAR	Patell Z
With Prior Information	{-3, 30}	19.64%	19.78%	6.24
	{-3, 10}	9.89%	10.72%	6.69
	{-3, 0}	4.76%	4.66%	6.75
No Prior Information	{0, 3}	8.97%	9.80%	11.45
	{0, 10}	9.93%	10.77%	7.79
	{0, 60}	14.02%	10.03%	5.05
	{0, 150}	20.07%	-6.27%	4.12
	{0, 300}	13.43%	-227.35%	3.36
	{0, 500}	22.55%	-481.65%	3.63